

# Endogenous sugar level is associated with differential heat tolerance in onion bulb scales

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## Abstract

Postharvest heat treatment stimulates desiccation and browning of outer scales of onion (*Allium cepa*. L) bulb to dry papery skins. Inner scales resist the heat treatment, as evidenced by high moisture levels. During heating, inner scales showed increasing soluble sugar levels followed by higher osmolarity, vs. a dramatic decrease in both in the outer scales. Exogenous feeding of outer scales with sucrose, glucose or fructose solutions before heat treatment reduced water loss during heating, suggesting a role for soluble sugars in water retention and therefore, heat tolerance. Vacuolar invertase (VInv) is a key enzyme regulating the levels of sucrose, glucose and fructose in plant tissue. In onion outer scales, VInv activity increased during heating but reducing sugars decreased, possibly due to their rapid metabolism during scale senescence to form skin. Transcriptomic analysis demonstrated upregulation of genes involved in lignin biosynthesis and secondary cell-wall formation in outer scales during heat exposure, and upregulation of genes involved in energy-related pathways in inner scales. This study reveals the dual role of soluble sugars in different onion scales, as osmoprotectants or building blocks, under heat stress.